

**WHAT IS CLAIMED IS:**

1. A method for performing camera position approximation for determining positions of a device used to capture an image, said method based on photogrammetric principles and comprising:

identifying three points in said image captured by said camera, wherein said three points have a known relationship and said image becomes an image plane;

projecting said three points' rays into an image space by intersecting each of said three points with a known focal point of said image plane.

choosing a point A on a first of said three points' rays at a location near said image plane;

based on said known relationship, identifying a point B on a second of said three points' rays;

drawing a circle with its center axis on a path AB and its radius such that known distances between points A and C and points B and C are respected;

choosing a point C on said circle closest to a third of said three points' rays;

repeating said choosing a point A so as to find a closest point C to said a third of said three points' rays;

wherein point A, point B, and point C define said device position and define its x, y, z coordinates; and wherein orientation angles  $\Omega$ ,  $\Phi$ , and  $\kappa$  can be calculated from said x, y, z coordinates of said points A, B, C, thereby defining said camera position.

2. A method for reconstructing planar objects, wherein said planar objects are captured in a plurality of two-dimensional images taken from different angles, said method based on photogrammetric principles and comprising:

reconstructing a set of points in an image plane in three dimensions using standard photogrammetric techniques for said plurality of two-dimensional images, said set of points comprising at least three points; and

calculating a three-dimensional position for a selected point on said planar object by identifying said point on one of said plurality of two-dimensional images; wherein said

calculating comprises intersecting a ray that passes from a focal point of said device through said selected point on said image plane and a plane that is calculated to fit well with the said set of points.

3. A method for performing a precision estimation of a measured three-dimensional coordinate based on Monte-Carlo simulation, said method comprising:

choosing a three-dimensional point in an imaged space and calculating said three-dimensional point's theoretical position in the image planes, whereby said point becomes a simulation point;

calculating reference points' positions in said image planes;

acquiring tolerances for said internal parameters and said external parameters from a system database;

adding a suitable amount of error to positions and parameters in said simulation, wherein said error is determined according to said tolerances;

reconstructing said simulation point based on its position in images obtained through simulation, said internal parameters, and said external parameters and producing a three-dimensional coordinate; and

comparing said three-dimensional point with said three-dimensional coordinate produced by said reconstruction to obtain said precision estimation.

4. A method as claimed in claim 3, wherein said precision estimation is repeated with different suitable amounts of error, and all results produced are averaged to obtain a better estimation.